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Hot dip galvanizing process ppt

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The hot dip galvanizing process involves several stages: pickling with hydrochloric acid, pre-fluxing with zinc ammonium chloride, hot dipping in molten zinc, and quenching in sodium dichromate. The process starts with degreasing using a caustic bath to remove oils, grease, and paint. This ensures the surface is clean for subsequent stages. Next, pickling with hydrochloric acid removes rust, mill scale, and other metal oxides from the steel surface. Pre-fluxing with zinc ammonium chloride conditions the clean steel surface for hot dip galvanizing. The hot dipping process involves immersing the steel in molten zinc at 450°C. The reaction between the clean steel surface and molten zinc forms a zinc-iron alloy, which is strongly bonded to the surface. This coating takes around 3-5 minutes to form, depending on the steel thickness. Finally, quenching in sodium dichromate cools the item quickly, allowing it to be handled, and passivates the surface of the galvanized coating to maintain its bright appearance. Throughout the process, it's essential to ensure that items are designed to prevent air, solutions, and molten zinc from becoming trapped. Coating is essential to maintain its bright appearance. Dichromate quenching can reduce white rusting problems, which occur when rainwater reacts with newly galvanized steel to form zinc hydroxide. Poor storage or HDG steel also promotes white rust. Zinc Zinc-iron alloys Steel Micrograph of hot dip galvanized coating The hot dip galvanizing process Characteristics • Typically 65 - 150 microns thick (1 mm = 1000 microns) • Zinc iron alloy layers make up 80% - 100% of the coating. • The zinc-iron alloy layers are harder than 250 grade steel. The hot dip galvanizing process Coating comparisons Compared to zinc electroplating and continuous galvanizing, hot dip galvanizing is better because it is thicker and lasts over 50 years or more without rusting. HDG is also harder and more abrasion resistant than ZEP and CG. Additionally, HDG coats all external and internal surfaces and edges. Coating thickness of coatings on galvanized products Z350 Gal. sheet HDG Heavy Coating thickness - microns Electroplating HDG Light The hot dip galvanizing process Zinc cost versus surface area versus zinc pickup Zinc price 2.00/kg Good design reduces excessive zinc pick-up Zinc oxide reacts with carbon dioxide to form zinc carbonate, a grey material that prevents further corrosion and protects steel. HDGI process involves various steps: controlling Si levels for HR and CR P, using Z1 to Z5 Zn grades, adding lead for fluidity, and chromate quenching to prevent reactions with concrete or water. Phosphating increases paint adhesion. A duplex coating is applied over the galvanized surface to provide synergistic protection. This coating offers 10 times more abrasion resistance, 8 times more chip resistance, and 20 times more edge protection. It also provides long-term corrosion protection and attractive appearance with unlimited color variety. HDGI has several layers: Eta (pure zinc), Zeta (94% zinc-6% iron alloy), Delta (90% zinc-10% iron alloy), and Gamma (75% zinc-25% iron alloy). The Delta layer is 60% harder than the base steel and protects from abrasion and corrosion. HDGI advantages include smooth coating, optimal protection of edges and corners, stress release, and robust coating. However, it has limitations such as product size restrictions, risk of distortion due to stress release, and peeling at high temperatures. Applications of HDGI steel include roofing and walling, safety barriers, handrails, consumer appliances, automotive body parts, and metal pails in heating and cooling duct systems. Coatings can be categorized into electrogalvanized and hot dip, both requiring chromate conversion coatings to prevent white rust. For high-temperature applications, sulfamate nickel plating is used. Electrogalvanized coatings are susceptible to zinc whiskers, while the thickness of the layer is a consideration. A key difference between hot-dipped and electroplated zinc lies in their thickness, with galvanizing being 10 times thicker on average. Electroplated zinc has a smooth, shiny appearance, making it suitable for aesthetic purposes. In contrast, galvanized coatings can appear spangled or grayish, and may interfere with fasteners unless accounted for. Electrogalvanized coatings are also prone to zinc whiskers. The thickness of the layer is a consideration in both processes. Galvannealing involves annealing metals to induce ductility, soften material, relieve internal stresses, refine the structure, and improve cold working properties, hardness, and ductility. This process produces specialized sheets with an iron alloy layer. Galvannealed steel has a medium-light gray appearance, offering good paintability, weldability, corrosion resistance, and formability. It is commonly referred to as Jet-Kote. Painting galvannealed steel is crucial to prevent water marks from forming. The automotive, signage, electric equipment, and other industries requiring good paintability and long reliable service life often utilize galvannealed steel. Galvalume is a trademarked coating consisting of 55% aluminum, 43.4% zinc, and 1.6% silicon. Its unique blend of corrosion resistance and high heat reflectivity makes it suitable for roofing, siding, unexposed automotive parts, appliances, furniture, outdoor cabinetry, computer cases, gutters, pipe, and other non-construction applications. The advantages of galvanizing steel include the exceptional durability of zinc, particularly in hard water where a passive layer of carbonates forms. The galvanized surface is also resistant to white rust. **Aluminized Steel & Hot Dip Galvanization** * **Aesthetic Aluminized Steel**: Offers a satiny appearance, enhancing product value. + **Type I (Al-Si alloy)**: Ideal for high-temperature corrosion resistance in industrial products (e.g., mufflers, furnaces). + **Type II (Pure Al)**: Suited for atmospheric corrosion resistance (not high temperatures) in applications like roofing and air conditioner housings. * **Aluminized Steel Structure**: 1. Thin outer aluminum oxide layer 2. Intermetallic layer (aluminum, silicon, steel mix) 3. Steel core + Highly resistant to corrosion with excellent heat reflectivity, mainly due to the intermediate layer. + Unlike zinc, aluminum provides only physical protection; corrosion occurs if the layer is compromised. **Hot Dip Galvanization Processes** 1. **Dry Process** (most commonly practiced) 2. **Wet Process** 3. **Continuous Process** **Dry Galvanization Process Overview** * **Step 1**: Sodium Hydroxide (NaOH) Treatment [10-15 Kg/100 Litres, 85-90º C] * **Step 2**: Acid Treatment (HCl or H2SO4) [100-150 g/Litre, with water rinsing] * **Step 3**: Zinc Ammonium Chloride (ZnCl2.3NH4Cl) Treatment [200-400 g/Litre, ambient to 80º C] * **Step 4**: Galvanizing Bath (>98.5% Zn by mass, 550º C) * **Step 5**: Quenching and Testing (including Sodium DiChromate treatment for